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Part First.

ORIGINAL COMMUNICATIONS.

ARTICLE I.— *On the Cerebro-Spinal Origin and the Diagnosis of the Protrusion of the Eyeballs termed Anæmic.* By THOMAS LAYCOCK, M.D., etc. etc., Professor of the Practice of Medicine and of Clinical Medicine, and Lecturer on Medical Psychology and Mental Diseases, in the University of Edinburgh.

(*Read to the Medico-Chirurgical Society of Edinburgh, January* 7, 1863.)

DURING the last few years the attention of the profession has been directed to a disease in which there is more or less of a general debility resembling anæmia, considerable and varied nervous disorder, greatly increased activity of the heart and of the arteries of the head and neck, a vascular enlargement of the thyroid gland resembling bronchocele, and staring eyes, with protrusion of the eyeballs, giving a peculiar expression to the face. This latter appearance, known as exophthalmos, exophthalmia, and proptosis, has attracted especial attention. No cause could be very exactly assigned for it; but since goitre is observed to be frequently associated with struma and other cachectic conditions, and anæmia with palpitation, the state of the eyes and the symptoms in general have been attributed to like causes. Hence the names which have been given to the affection. Thus Dr Mackenzie designates it anæmic exophthalmia; Datin, serous (or dropsical) exophthalmia; various French and German writers, cachectic exophthalmos and exophthalmic cachexia; Henoch, Schoch, and other Germans, *exophthalmos ac struma;* Basedow, the goggle-eyed cachexy. Amongst the foremost investigators, both in date and success, is our co-member Dr Begbie, the title of whose valuable essay on the disease, lately published, sufficiently indicates his opinion of its chief cause.[1] In expressing my dissent from his theory of causation, I am bound to say that I think he has exhausted the arguments in favour of it. The objections to the anæmic theory are, however, weighty. Cases have been observed in which there were not only none of the admitted symptoms of anæmia, but in which bleeding, restricted diet, and purgatives had a directly favourable influence on the disorder. Dr Begbie has disinterred such a case from the first volume

[1] "Anæmia and its consequences: Enlargement of the Thyroid and Eyeballs;" in "Contributions to Practical Medicine," p. 116.

of Johnson's Medico-Chirurgical Review.[1] Then the symptoms and signs which are relied upon as diagnostic of anæmia are of questionable value. These are, pallid countenance, œdema or anasarca, rapid pulse and faintness, breathlessness on slight bodily or mental exertion, and the so-called hæmic murmurs in the large vessels of the thorax and neck and the jugular vein. But these diagnostic phenomena are by no means so trustworthy as has been usually believed, if we attach any definite meaning to the term anæmia. If by this be meant degradation or diminution in number of the red corpuscles, or increase of white corpuscles or degeneration of the fibrin and other elements of the blood, known variously as leukæmia, leucocythæmia, spanæmia, hydræmia, and the like, then it is certain that none of the signs or symptoms commonly mentioned is pathognomonic. Of these, perhaps, the soft blowing murmur heard in the precordial region and the palpitations are the most relied on; yet those physicians who have specially directed their attention at the bedside to these so-called hæmic murmurs and anæmic palpitations, have had serious doubts whether in fact they are really consecutive to anæmia or spanæmia as a cause. In the clinical wards of the Royal Infirmary, this class of cardiac murmurs are, according to my experience, of quite infrequent occurrence as compared with the organic, and yet the cases of anæmia and spanæmia are numerous. And in the worst kinds of blood-diseases, such as splenic leukæmia or confirmed Bright's disease, when, according to the theory, we should surely observe them, they are comparatively absent. These objections apply with equal force to the arterial pulsations and the breathlessness which accompany the palpitations. Nor are the physiognomical signs more conclusive. Pallor is, according to my experience, by no means a necessary proof of impoverished blood. I have examined the blood microscopically of very many patients, nearly 300 I think, and have often been struck with the discrepancy in certain cases between the microscopic and physiognomical signs. In cases of remarkable pallor of the face and lips, I have been surprised to find that the blood under the microscope, so far as the state of the corpuscles can be ascertained, was healthy. Œdema is another sign greatly relied on as pathognomonic of anæmia, especially if conjoined with pallor; yet it is open to the observation of every one, and I have often pointed out the fact in the clinical wards, that there may be no œdema in the worst cases of blood degeneration, as proved by the microscope, and with extreme pallor; or the œdema, if it occur, may be of the most trifling character; while, on the other hand, extensive œdema may come on with no corresponding change in the blood. I have already published facts which prove that in one class of cases there would be no œdema or anasarca but for certain changes in the nerves of the part affected, or in the central axis, and that such changes will even cause œdema of the most extensive

[1] Under the head "Medical Miscellanies." Dr Parry also gives a case—"Collections from Unpublished Writings," etc., vol. ii. p. 125.

character to disappear.[1] This remark applies, indeed, equally to the other alleged signs and symptoms of anæmia; they may all result from disorder of the nervous system.

The same mistake in diagnosis is made as to the causes of, and the condition of the blood in, purpura and purpura hæmorrhagica. These are often consecutive to leukæmia and the worst forms of spanæmia, and are almost pathognomonic of the blood degeneration known as scorbutus; hence it was concluded, and indeed is still very generally held, that they are always connected with cachectic conditions. Yet, Dr Parry showed, fifty years ago, that there was a sthenic form of purpura to be relieved by blood-letting and antiphlogistics, which came on in persons who had been in no degree or manner exposed to the causes of scorbutus.[2] Further, there are some fallacies as to the causes of anæmia itself. In many of the recorded cases of anæmic exophthalmos, nay, in the majority, the patient was first subject to conditions mental or bodily which powerfully influenced the nervous system, then nervous symptoms arose, and then anæmia. Here the chain of events points to a morbid condition of the nervous system as the cause of the anæmia. That blood degenerations arise in this way is, I venture to say, as certain as that they arise from the causes ordinarily specified.

There are two forms of anæmia, it will be admitted by all, in which cardiac and vascular symptoms like those we have been considering do certainly occur. The one is that which follows upon very profuse loss of blood during parturition, and the other the anæmia of young women, termed chlorosis. But it is a very significant fact, that in the hæmorrhagic form the vascular disturbance is not restricted to the vessels of the head and neck, as it is in the disease under consideration, while in the chlorotic there are circumstances in the causation and course which render it doubtful whether it should not be classed with that disease. There is one sign, however, which merits special notice, because it is of as frequent occurrence as either the blood-defect or the vascular and nervous symptoms, and that is the increased production of heat. It is usually described as flushings or burnings, but it occasionally is so great as to excite a longing for cool air, or "air-hunger," as the Germans term it.[3] Now this is exactly like what is seen in cases of hæmorrhagic anæmia, in which the increased heat of body is most distressing to the patient. And it is most significant of the true character of this symptom, that this morbid increase of temperature is not only sometimes a certain forerunner of death, but in one class of cases is observed to take place after death, as in epidemic cholera and yellow fever. Perhaps the most striking example of this kind on record, is one mentioned by Dr Davy in his recently

[1] Clinical Lecture on Physiognomical Diagnosis. Med. Times and Gazette, May 31, 1862.

[2] Edinburgh Medical and Surgical Journal, vol. v. p. 7.

[3] Such a case of chlorotic exophthalmia is detailed by Withusen, in Dr Moore's Translation, Dublin Medical Press, July 13, 1859.

published work,[1] in which the post-mortem temperature (it was a fatal case of cellulitis with multiple abscesses) rose to 113° Fahr. Such a condition would seem to be conclusive as to the anæmic origin of the disease under consideration; yet when the inquiry is pushed further, even the increased heat is found to be a result of nervous lesion, as I shall shortly prove.

Looking at all these facts and considerations, it is not surprising that although the anæmic theory of causation is very generally adopted, there are those who think that the group of symptoms are more or less of nervous origin. Dr Stokes, in particular, entertained the opinion at an early period of the inquiry, and has expressed it in his valuable work on "Diseases of the Heart." The disease, according to his view, is a special form of cardiac neurosis, while he looks upon the exophthalmos and thyroideal enlargement as secondary phenomena, due to the cardiac disturbance. In this particular he agrees with Dr Begbie and other observers. Very lately, however, even these have been attributed to nervous disorder. The pathology of the affection was discussed, in this sense, during the year 1860 in the Paris Hôtel Dieu by Professor Trousseau.[2] Previously to this date, however, M. Kœben, in Archives Generales for 1859, had attributed the affection to a lesion of the sympathetic, and M. Aran, the eminent physician to the Hospital St Antoine at Paris, lately deceased, expressed his concurrence in that opinion. Very recently, the pathology of the disorder has had a full examination in the Royal Academy of Medicine in Paris, on the occasion when a report upon it was presented to the Academy by Professor Trousseau, as convener of a committee appointed to investigate. The conclusions of the report were, that it is a *neurosis* analogous to hysteria, having its seat in the vaso-motor nerves and ganglia, and characterized by local congestions of nervous origin.

Other causes may be very plausibly assigned. In a certain class of cases, the symptoms and course seem to point to a rheumatic origin and complication, falling to be classed in this respect with certain kinds of chorea. In another class, the spleen seems to have been predominantly implicated; and in another, and indeed very numerous class, the generative system. As to my own experience and conclusions I may say, that although the exophthalmos has attracted the greatest attention, it appears to me very doubtful whether it is to be held as a pathognomonic sign, or as more than a local symptom and complication of a more general disorder, in which a certain definite tract of the cerebro-spinal axis is involved. In short, I think it is to be classed with squints, oscillating eyeballs or nystagmus, drooping lids or ptosis, and similar affections of the ocular-motor system, and which indicate either local or general lesion of the nerve-centres. As such, it is just as commonly a coincidence as a consequence of anæmia, and due to the same causes.

[1] On some of the more important Diseases of the Army.
[2] Clinique Medicale de l'Hôtel de Paris.

Hence, besides the scientific interest attaching to the affection, it has a high practical value. Indeed, while investigating carefully the pathology of this curious group of morbid conditions, the conviction has been forced upon me that a knowledge of it will include the elucidation of some of the most fundamental and most important points both of the theory and practice of medicine. And with this end in view I shall, on the present occasion, consider the exophthalmos chiefly, reserving the bronchocele, the palpitation, and the other morbid states for separate and future consideration. It will be useful, however, to obtain, in the first instance, a general idea of the morbid states to be investigated. The histories of the recorded cases differ much as to details, but I think that which Dr Begbie first brought before this Society may be taken as affording a typical example of the affection when fully developed. The patient was a woman and aged thirty-two: she was childless, although married for six years and enjoying subsequently to marriage a fair state of health. For some time, however, she had had profuse leucorrhœa, and she had also suffered from continued anxiety and distress of mind. For four or five months previously to coming under observation, she had experienced inordinate palpitation of the heart, which was greatly increased by muscular efforts of any kind; at which times her face, otherwise pallid, flushed, and she became confused. The eyes were prominent and staring, giving a wild and startled expression to the countenance, the albuginea unusually visible and darker than natural, from a highly-developed vascularity. There was a painful sense of distention of the eyeballs, but no dimness of vision. These conditions were aggravated when the face was flushed, or the heart more violently excited. An enlargement of the thyroid was manifested *simultaneously* with these symptoms; but in the majority of the recorded cases it preceded the enlargement of the eyeballs, yet was consecutive to the palpitation. The gland rapidly increased in size, but varied much in this respect according to the state of mind, rest, or palpitation. It appeared to be highly vascular, and conveyed to the touch the sensation of an erectile tumour. The condition of the heart and vascular system was striking: the pulse generally ranged from 100 to 130; it was small and jerking, and, on the occasion of excitement, accompanied by a thrill. A beating was felt in the head, and there was a state of almost constant watchfulness. There was much breathlessness, frequent faintness, severe headache, vertigo, tinnitus aurium, a high degree of nervousness, and much derangement of the digestive functions. A soft bellows murmur was heard at the aortic orifice, and in the carotid and other large arterial trunks, but no increased sense of dulness, nor peculiarity of impulse. The catamenial discharge was imperfect and irregular, and leucorrhœa occupied the interval. The case terminated in health, under a tonic plan of medicine, diet, and regimen.

Paroxysmal Exophthalmos.—The exophthalmos and bronchocele

may, however, be so trivial in extent, or so transient in occurrence, being in fact paroxysmal, as not to attract notice, while the other symptoms may attain to an alarming importance; and the blood-degeneration may be manifested by local hæmorrhages, the extreme palpitation may be associated with intense pain in the back or the precordial region, the increased vascular activity in the head and neck be accompanied by globus and other hysterical symptoms. When, therefore, as to such cases the exophthalmos and thyroideal enlargement are constituted pathognomonic signs, a misapprehension as to the true nature of the disorder may easily arise from the trivial or paroxysmal character of the morbid changes in the eyeballs and thyroid body. This misapprehension occurred, I think, in two cases of paroxysmal exophthalmos which came under my observation many years ago, and one of which was published.[1] One patient was a young girl of highly nervous temperament, who, at the age of eighteen, was admitted into hospital for a supposed inflammation of the knee. This had come on after a fright, at the age of seventeen, at the moment she was menstruating for the third time. It was accompanied by pain in the hip and back, shooting down the thigh, and was in fact an example of the "hysterical" knee described so well by the late Sir B. C. Brodie, for which she had during several weeks been heroically treated. Soon after admission she perspired so profusely that her bed and body linen would be completely soaked, and she would lie at the same time with only a sheet over her, on account of the great heat of the surface. This condition continued for many months under my own eyes. She also complained of dreadful palpitations, which were so severe sometimes as to stop her breath. The action of the heart was exceedingly tumultuous, and the pulse was from 115 to 155 per minute. From time to time the fingers and thumb of the right hand presented a mottled, livid appearance, and there was an aching pain along the arm; at other times the left hand was affected, becoming purple, while a deep-red blush extended along the forearm, with a sense of aching and smarting. At these times the perspirations were incredibly profuse, the pulse 144 to 158 and undulating. The action of the heart was distinct and forcible, but no murmur audible. Dyspnœa was very distressing, with acute pain under the left mamma, frequent syncopes, and globus. This state, during the latter periods of observation, passed into a sort of convulsive fit, when the throat swelled very much, and the eyes started from their orbits. No attention was paid to these appearances at the time, as they were attributed (and I am now satisfied erroneously) to the strangulation she experienced. They were evidently part of the paroxysm. This patient had a wonderful variety of symptoms in addition to those mentioned. The surface of the body was sometimes exquisitely sensitive; the tongue was always dry and brown, except at the edges, so that practitioners

[1] Case of Elizabeth Camidge, Edin. Med. and Surg. Journal, April 1838, p. 441.

who saw this and felt her pulse invariably diagnosed the case as one of intense fever. Hæmatemesis, apparently vicarious, frequently occurred, and pain in the region of the spleen; loss of appetite was strongly marked, with a most unconquerable dislike to animal food,—a symptom noted by Dr Begbie as characteristic of the cases generally. Although the perspirations were so profuse and continuous, and the appetite bad, she was not at all emaciated. The head symptoms were like those in other cases—extreme wakefulness, vertigo, and the like, but no mental disturbance. The face was pallid when not suffused paroxysmally, which was often the case, when the perspiration would stand upon it in large beads. The sequel was never published, but she recovered a moderate share of health (having only a small bronchocele), married, and had children.

The other case of paroxysmal exophthalmos that came under my notice was that of a respectable youth aged sixteen, who was extremely pallid, and had a small enlargement of the thyroid body. He was very nervous and excitable, and troubled with severe palpitation, which from time to time was so aggravated as to threaten suffocation. At this time the swelling in front of the throat became much larger, and the eyes, which always had a wild expression, became prominent and staring. The nervous and cardiac symptoms were attributed to anæmia and hysteria, and the exophthalmos and thyroideal enlargement to congestion, the result of dyspnœa. The patient recovered under change of air and tonics.

Emotional Exophthalmos.—The exophthalmos may be caused by emotion. A third case that came under my notice was pointed out to me in the street by a non-professional friend as a great curiosity; it was a woman, aged about forty, who was passing with large goggle eyes, which, he said, "had been forced out of her head by a fright." I afterwards took the opportunity of seeing her, and found that she had experienced a fright when pregnant, and that the eyes became prominent shortly after. She had also a large bronchocele, which, she alleged, also came on during pregnancy. She was anæmic-looking; her pulse very quick, her manner exceedingly nervous. Her case was of long duration, but how it ended I know not. The difference of age and of physiological condition due to married life and childbearing are important elements in a comparison of this case with the others. A fourth example may perhaps be referred to this head, which came under my notice, in the case of a young gentleman, aged twenty-three, a student of the university, who was in a state of great anxiety about his success at his examinations. He complained of extreme nervousness and violent palpitation. His face was suffused, his eyes had a peculiar glitter and stare, and on baring his throat I found a bronchocele the size of a St Michael orange. Pulsations were felt in the tumour, as well as in the carotids, in which strong vascular action was observable. He had tinnitus aurium, vertiginous sen-

sations, and other uncomfortable head symptoms, all of which were much aggravated by study. The tongue was loaded, the breath offensive, the nights almost sleepless. There were marks of a rheumatic habit and a history of rheumatism, but no physical signs of heart-disease. Such a series of symptoms, however, in association with heart-disease and dropsy, especially in women, are not of unfrequent occurrence, and are, I think, due to the same causes as in others, but arise as complications.

Classification of Cases of Exophthalmos.—It will facilitate inquiry if the various conditions under which the exophthalmos occurs be arranged and classified. Now, taking an example like that observed by Dr Begbie as a standard of comparison, we can differentiate those that occur, or are likely to be met with in practice, into groups as follows:—

1. *Neuralgic and Hysterical.*—In this group there are neuralgic affections of different degrees of intensity. Sudden spasms or pains in the precordial region may accompany the palpitation, or orbital pains may complicate the exophthalmos. Or there may be the most striking hyperæsthesia of the skin generally, and of the special senses.

2. *Paroxysmal.*—The exophthalmos and bronchocele may be developed paroxysmally to a considerable extent, but subside so much in the intervals as hardly to be recognisable, or this may be the case as to the exophthalmos only.

3. *Orbital and Facial.*—The nervous symptoms, and especially the palpitations, may be less marked, but myopia, weakness of vision, and orbital and frontal neuralgia, accompany the exophthalmos. In these cases there may or may not be bronchocele.

4. *Cardiac and Cephalic.*—The symptoms referrible to the head and heart may be strikingly predominant, but the exophthalmos and bronchocele be little marked, especially in the earlier stages.

5. *Thyroideal and Cervical.*—Bronchocele, with pulsating thrills in the carotid arteries and the vessels of the thyroid, may be strikingly marked, but no urgent cardiac symptoms or exophthalmos.

6. *Complicated Cases.*—Complications may either precede or follow the local affections. (*a*) There may be uterine disorder. (*b*) The anæmic condition may be associated with hæmorrhages, especially meningeal, gastric, intestinal, and uterine. (*c*) Rheumatism and rheumatic affections may coincide. (*d*) Diathetic degenerations, chiefly atheroma of the arteries involved, as the aorta and ophthalmic and thyroideal arteries, and structural diseases of the thyroid, heart, and pericardium. (*e*) Disease, consecutive to these, especially dropsies and Bright's disease.

A true pathology of the disease, or group of diseases, must necessarily include an explanation of both the nature and course of each of the leading symptoms and their relations to each other, and of their complications. At present I refer only to the exophthalmos.

The State of the Eyes in Exophthalmos.—The affection is symme-

trical, unless there be an orbital complication; the eyes are staring, —that is, the eyelids are more widely apart than natural, and the globe protrudes. But it is by no means neeessary that there shall be both the stare and the protrusion. The lids only may be affected, so as to show the white of the eye preternaturally, and thus give a fallacious appearance of protrusion. The extent to which either symptom takes place varies remarkably with the emotional condition of the nervous system, and this is easily induced. Various mechanical theories have been advanced to explain the apparent or real protrusion; as, for example, dropsy of the globe, venous turgescence within the orbit, unusual deposit of fat behind the globe, and the like, but pathological anatomy has shown that none of these theories are sufficient. The change is doubtless in the motor mechanism of the eyelids and eyeball; but even the theory of this view is imperfect, partly because the morbid action of the palpebral muscles has not been taken into consideration, and partly because it seems probable that we do not yet know all the motor mechanism of the orbit. Mr Turner, assistant to Professor Goodsir, has lately demonstrated that there is an unstriped muscular structure in the orbit hitherto overlooked, which, from its attachments, he designates the periosteal muscle. If Mr Turner's dissections be confirmed, this periosteal muscle must be held to have considerable influence in protruding the globe.[1] What, however, we certainly can say, is this, that both the paralytic and spasmodic action of the muscles involved must be considered; so that retraction of the eyeball is the correlative of protrusion, and a drooping eyelid or ptosis of a wide-open eyelid or proptosis.

Causes of Exophthalmos.—These may be investigated either by observation or experimental research, and here it will be useful to remember that protruded and staring eyes and their correlatives are by no means of uncommon occurrence. In cases of death from strangulation the eyes are seen staring and prominent. Under a powerful emotion of fear or terror, and even when severe bodily pain is felt, the eye stares. Then there are cerebro-mental diseases involving the emotions and the intellect, in which the same appearance is so common that the expression of the countenance in cases of exophthalmos is described by several writers as being wild and maniacal. As to all these various instances it is a fair presumption that in each the same mechanism of the eyeball is influenced through the nervous system. There are other kinds of symptomatic exophthalmos which may arise from somewhat different conditions; as, for example, that which is so strikingly manifested in some cases of chronic mania complicated with epilepsy. Sir A. Morrison gives, in his "Physiognomy of Mental Diseases," an illustration of this kind (plate xi.) It is the case of an epileptic, aged 60, subject for many years to periodical attacks of furious mania. In plate E

[1] Natural History Review, January 1862, where Mr Turner ably discusses this question.

of the Appendix there is a delineation of the staring eye, with insane fear, after Hogarth. A remarkable prominence of the eye is also observed in certain forms of mania with general paralysis, and this, according to my experience, may be seen even in persons predisposed to the disease. In none of these symptomatic forms of exophthalmos is there reason to think the eyeball is enlarged, any more than in the emotional exophthalmos. The symptom is due, therefore, to changes in the motor mechanism of the eyeball and eyelids occurring consecutively to changes in that part of the nervous system more particularly connected with the eye; and, consequently, the primary questions for solution are what are the nerves, and what the nerve-centres involved in the affection?

Pathological Anatomy.—Now, I shall proceed to show that a solution has been rendered at least possible of late years, by a series of brilliant researches into the functions of the nervous system, conducted by Stilling, Claude Bernard, Schiff, Budge and Waller, Brown-Séquard, and others. And I think in bringing these under the notice of the profession, and showing some of their varied applications to the practice of medicine in general, as well as to the elucidation of the symptoms under consideration, I shall be excused some little divergence from a bare statement of facts. A very distinguished anatomist and physiologist in his day, Pourfour du Petit, was the first, in 1727, to show the influence of injury of the cervical portion of the sympathetic system on the eye.[1] He observed contraction of the pupil, retraction of the globe, and redness of the conjunctiva, to result. These observations were confirmed by numerous subsequent experimenters; but, in 1845, M. Biffi of Milan added the important fact that when the iris was contracted in consequence of division of the cervical sympathetic, it became dilated if the upper end of the nerve was galvanized. In 1852, Professor Claude Bernard further elucidated the question. He ascertained that the surface became more sensitive and the vessels fuller of blood; that the small arteries pulsated with greatly increased force; and that the temperature was greatly raised on the side of the head operated on, both externally and as to the parts within the cranium; that as to the eyelids and eye there was contraction of the pupil, a narrowing of the opening of the lids, retraction of the eyeball, a projection over it of the third eyelid which the animals operated on possess, and a flattening of the cornea. But when the upper end of the nerve was galvanized these conditions were reversed, and there resulted diminished heat and vascularity, dilatation of the pupil, enlargement of the opening of the eyelids (or staring eye), and protrusion of the globe; in short, he produced exophthalmos.[2] And the tendency to it was so forcible under these

[1] Histoire de l'Academie des Sciences, 1727. "Memoire dans lequel il est démontrè que les nerfs intercostaux fournissent des rameaux qui portent des esprits dans les yeux."

[2] Comptes Rendus, tom. 36, p. 375.

circumstances, that the phenomena were manifested in an animal which held the eye tightly shut, in consequence of a drop of liquor ammoniæ having been dropped into it. Here, then, we have a clue afforded as to the nerves and the muscular mechanism involved in nervous exophthalmos.

Nor is this all. In the increased sensibility, heat, and vascular activity of the side of the head operated on, there is a proof of the influence of local morbid states of the nervous system on the development locally of those phenomena as symptoms. Now, these are leading points to be investigated, and at the first glance it might be supposed (as I certainly was led to think), that the exophthalmos and increased vascular activity in the head, neck, and face observed in these cases, might be attributed to the pressure of the enlarged thyroid on the cervical sympathetic, or to some other lesion of that nerve sufficient to influence its functions. The objections to this theory, however, are manifest. Not only have we numerous examples of very large bronchocele without such results, but exophthalmos frequently occurs when there is no bronchocele. Besides, if this cause be admitted (and in some instances at least it may be a cause), how comes the heart to be in pathological relation with the eyes? In truth, until the last few years, the attempt to solve the questions thus arising was hopeless; happily experimental research has demonstrated a hitherto unknown physiological connexion between the eyeball and lids, and a definite tract of the spinal marrow. Two eminent physiologists working together, viz., Dr Waller and Professor Budge, discovered that if they galvanized that portion of the spinal cord of a rabbit which extends between the first cervical and the sixth dorsal vertebræ, they excited dilatation of the pupil. They, therefore, designated this region the "cilio-spinal region." The point of maximum intensity was found to correspond in the frog to the articulation of the second and third dorsal vertebræ, and to the origin of the second dorsal pair of nerves.[1] Following up these researches, Prof. Claude Bernard has recently traced a connexion in the dog between the anterior roots of the two first pairs of dorsal nerves and the muscular mechanism of the eye. If these were divided on one side without injuring the spinal cord or the sympathetic in the thorax, the eye of that side is affected, the pupil contracts, the opening of the eyelids narrows, and the eyeball is retracted and diminished; but there is no increased sensibility, heat, or vascular activity induced. And when the peripheral ends of the divided nerves are galvanized, the same results follow in the eye as when the upper end of the cervical sympathetic is galvanized,—that is to say, widening of the eyelids, dilatation of the pupil, and exophthalmos. Hence the conclusion, that the motor nerves of the eyes of the dog originate and decussate in the spinal cord at the dorsal region. It is necessary, however, according to the results of Prof. Claude Bernard's researches, to distinguish

[1] Comptes Rendus, tom. 33, p. 372.

between the sympathetic and spinal nerves of the eyes. When he divided the ascending trunk of the sympathetic on the side of the vertebral column between the second and third rib, carefully avoiding the spinal cord and nerves, he induced increased sensibility, heat, and vascularity of the ear and lateral half of the head on the same side, but no change in the eyelids, eyeball, or pupil. Hence the conclusion, that the nerves subservient to heat and vascular activity (the vascular and calorific nerves) are sympathetic, those which regulate the movements of the eye are spinal. But these motor nerves are equally with the vascular (including the cardiac nerves), and the calorific in relation with that portion of the cerebro-spinal axis which influences the circulation and muscles of expression when emotions are experienced; and this is true, even of the emotional state of feeling termed pain, for Claude Bernard found that if any sensory nerve be pinched from the sciatic to the fifth, reflex ocular movements result, constituting dilatation of the pupils and widening of the eyelids. I do not propose on this occasion to explain the connexion between these conclusions and the causes of the palpitations, arterial pulsations, vascular bronchocele, heat of surface, and increased sensibility, and other symptoms which accompany the exophthalmos, because the subject merits a separate consideration. I would only observe that it has been long known that the heart and vascular system are the seat of various functional disorders of a painful kind, in cases of so-called spinal irritation, especially in young women predisposed to hysteria and hysterical affections. In such patients, nervous and hysterical palpitations, in all respects resembling those of the disease in question, exclusive of the bronchocele and the exophthalmos, are very frequent. Many years ago, I pointed out the fact that the motor fibrils of the heart are derived from the spinal cord as well as from the sympathetic, and thus tried to explain the character and origin of these nervous or hysteric palpitations, and indicated the diagnosis.[1] All the most recent researches on this point tend to establish these views, and to prove that the heart is in direct relation with a special motor tract of the spinal cord, commencing and continuous upwards with this oculo-spinal region. Consequently, any sufficient causes acting morbidly upon that portion of the cord, or upon the cerebral connexions within the cranium (as during emotions), or upon the motor roots of the two or three first pairs of dorsal nerves, would tend to induce not only the "oculo-pupillary changes," but also increased vascular activity in the region of the cervical sympathetic, and palpitation of the heart. These remarks apply with equal force to certain cephalic symptoms, and which are quite as prominent as the conditions just examined; such as tinnitus aurium, flushes, nervous headaches, neuralgia of the face and orbits, and wakefulness; and also to the precordial anguish, painful sensibility of the trunk, and neuralgia of the spine and upper

[1] On the Nervous Diseases of Women, p. 270. London, 1840.

extremities. Some of these are due to morbid conditions of the cervical sympathetic primarily, others to affections of the ganglia on the posterior roots of the spinal nerves (the intervertebral ganglia), and of the sensory tract, occurring either consecutively to the vaso-motor neuroses, or arising independently. The whole subject is, however, too large in extent to be examined now.

Orbital Exophthalmos.—It is necessary, however, to an accurate diagnosis of the various forms of staring and protruding eye, to examine the relations of the eyeball to the Gasserian ganglion, which is the ganglion of the posterior roots of the nerves of the face; for, undoubtedly, a species of exophthalmos arises in consequence of diseased states of that ganglion. This connexion was first demonstrated experimentally by Majendie in 1824, and pathologically by M. Serres in the following year. Of later years Schiff has very successfully investigated the subject. As the experiments of Professor Claude Bernard are more accessible, I need only remark that, by an ingenious method of operating, he divides the trunk of the fifth nerve in rabbits and dogs: the result is, that a degree of exophthalmos immediately takes place, and the cornea becomes more conical.[1] It is, however, of much diagnostic importance to observe that the vascular phenomena which accompany this kind of protrusion of the eyeball are very different from those already described as of spinal or sympathetic origin; for, though turgescence of the vessels of the conjunctiva takes place, the heat and vascular activity of the tissues involved are not increased, but strikingly diminished; so that, when the animal is in bad health, inflammation of the conjunctiva, with opacity and necrosis of the cornea, follow, and the eye is destroyed. And there is a probability, at least, that the effects of the injury are felt in the brain beyond the orbital tissues. Now, as structural disease of the ganglion has been proved by Serres and others, as also my own observations show, to be followed by similar changes, we have in these facts a ground for diagnosing trigeminal or orbital exophthalmos from sympathetic or spinal. In several recorded cases there were myopia, neuralgia, œdema of the eyelids and conjunctiva, passive congestions and inflammations of one eye, or of one predominantly, if both were protruded. Such phenomena enable us to distinguish a trigeminal from a sympathetic or spinal exophthalmos, because, in the sympathetic kind, the nutrition of the eye is not only wholly unaffected, but the increased vital activity of the tissues enables them to resist cold and the other causes of inflammation, even although not covered by the lids. This peculiarity of the exophthalmos under consideration is particularly noticed. When the fifth is affected, the results are wholly different. The case communicated to Mr Fisher by Dr Désgranges was probably of this trigeminal kind.[2]

[1] Leçons sur la Physiologie et la Pathologie du Système Nerveux, 1858, tom. ii. p. 51, et seq.

[2] Archives Generales, 1859. Exophthalmie Cachectique, *Obs.* v. p. 533.

Sources of Fallacy in Diagnosis.—It is probable, however, that in a certain class of cases both kinds of nerves are involved, and then the diagnosis will be doubtful. For, when this takes place, there will probably be a remarkable modification of the phenomena as caused by either singly. If, for example, congestion, a lower temperature, defective nutrition, and other changes, have occurred in the eye from injury of the fifth nerve, a lesion of the cervical sympathetic will relieve the congestion and restore the temperature, or, in other words, will antagonize the morbid influence. Claude Bernard found that the temperature of the left ear of a dog fell 3° C. below the right ear after division of the fifth on the left side; but, when he divided the left cervical sympathetic, the temperature of the left ear rose 6° C., while that of the right fell 6° C.[1] If, therefore, a case were met with in which both kinds of nerves were involved, the pathognomonic signs of neither the one nor the other class of lesions would be manifested, and thus the singular result would follow of serious nerve-injuries so antagonizing each other as to remain totally obscured. Another source of fallacy in cases of centric origin will be found in a physiological fact almost wholly, if not altogether, overlooked by physiologists, but which I have seen so often illustrated by disease, that I am satisfied it is of frequent occurrence, and that is the crossed action of the sympathetic nerves and ganglia, owing to decussation of their fibrils and commissures in the cerebro-spinal centres.[2] I have seen remarkable examples of this crossed action in anasarca; as, for example, in a woman in the clinical wards in November 1861, who had valvular disease and the most extreme œdema of the extremities. She had an attack of hemiplegia of the left side, which was due, as the post-mortem examination proved, to plugging of the right middle cerebral artery. Now, there was increased œdema of the right or non-paralyzed leg and arm, but the left leg, which was wholly useless, ceased to be anasareous, and became quite small. Here the injury to the right hemisphere plainly led to the change in the left limb. To what extent these central changes in the vaso-motor system influence the states of the circulation in distant parts is as yet wholly uninvestigated, but I am inclined to think they modify the production of exophthalmos and the vascular changes in at least certain cases of general paralysis.

Ptosis or Drooping Eyelid.—The condition of the eyelid, as distinct from that of the eyeball, is of importance in diagnosis; there may be a staring eye without a protruding globe. Now, taking the results of Professor Claude Bernard's experiments as a guide, I think it may be inferred that the drooping or partially closed eyelids may be as pathognomonic as the widely open; nay, perhaps more conclusive, inasmuch as paralysis of the cervical sympathetic is much more likely to occur as a morbid state than that half-

[1] Leçons, etc., tom. ii. pp. 480–482.

[2] See this question mooted in my "Mind and Brain," vol. ii. pp. 400 and 405.

tetanic, excited condition, which galvanization induces. And it is perhaps for this reason that the staring eye is comparatively so rare. A drooping eyelid, therefore, with or without retraction of the eyeball, together with greatly increased vascular activity in the neck, head, and eyes, may be more pathognomonic than the staring eye with its widely open lids. In the case of paroxysmal exophthalmos or proptosis already referred to, symmetrical ptosis or drooping lid was a very striking symptom when there was no excitement. When one eyelid is affected the lesion is probably local. I had recently an example of this kind in the case of a female patient sent to me from Ireland by a medical friend. He informed me that she had long suffered from dull heavy frontal headache, aggravated by stooping, and accompanied by vertigo, muscæ volitantes, and ringing in the ears, and sometimes with nausea and vomiting. At the same time she had a good deal of thirst, and habitually cold feet. A confined state of the bowels and weakness of the back had come on during the last three years, and, within the last three months, drowsiness, tenderness of the eyes on pressure, intolerance of light, and ptosis, particularly of the left eye, leading to the suspicion of obscure cerebral disease. On examination I found that there was a thick neck and a small bronchocele, of which the right half was larger than the left. The ptosis was now limited to the left eye, the patient being unable to raise the lid, and there was increased heat on the left side of the head. After treatment with extract of chamomile, nux vomica, and sulphate of iron, in small doses, the ptosis and other symptoms disappeared, and the enlargement of the thyroid was now restricted to the right lobe. It is worthy of notice that thyroideal and glandular enlargements had occurred in three or four of this patient's relatives.

General Conclusions.—It may be inferred from these facts, 1. That the exophthalmos under consideration is specially due to disorder of the nervous system. 2. That it varies in character and diagnostic significance accordingly as it is associated or not with other phenomena involving the vascular system of the heart, and of the eyes, head, and neck—the carotideal as distinct from the vertebral system of capillaries. 3. That it is sometimes of spinal, sometimes of cranial origin; and that in either case its nature and seat may be diagnosed. 4. That it occurs under a variety of morbid conditions of the nervous system.

If it might be permitted to theorize on the causes of symptomatic exophthalmos from these data, we might conclude that, when it occurs in strangulation, it is probably due to mechanical injury to the cervical sympathetic by the tightened cord or other violent means used; in the emotional form the condition is probably like that when the sympathetic is galvanized, the face being pale, and the eye staring; in certain morbid cerebral conditions, such as mania, with epilepsy and general paralysis, the lesion is probably in the first instance paralysis of the sympathetic, and subsequently

of the fifth and seventh; and, finally, that in the class of cases under consideration, when the exophthalmos is symmetrical, it is spinal; the cervical and upper dorsal region being the seat, together with the corresponding cervical and dorsal divisions of the sympathetic; but when unsymmetrical, it is due to disease of the trigeminal ganglion and branches of the fifth pair.

[*Note as to the state of the Eyes in cerebral mental diseases.*—Three years ago, my friend Dr Rorie, superintendent of the Dundee Asylum, examined, at my request, the eyes of patients under his care, in respect to their prominence, state of pupil, and other matters. Of each sex, 86 were examined; of the females, 26 had prominent and 4 very prominent eyes, together, nearly 35 per cent.; of the males, 11 had prominent and 6 very prominent eyes; showing the considerable excess of 15 per cent. amongst the females. It is required to know, however, what is the natural proportion, absolute and relative, before we can determine how far these states amongst the insane are morbid. Changes in the pupils were also observed by Dr Rorie, and he found that there was a difference in the two eyes. Of 7 females, the left pupil was more dilated than the right in 5, and of 8 males 6; or, in other words, the left was more dilated than the right in the proportion of 11 in 15. But then he found also that the same difference could be observed in persons apparently healthy. One only in 172 patients had sunken or retracted eyes, and he was formerly subjected to paroxysms of rotatory movements, and one, an epileptic male, had the left eye more prominent than the right.]

RUTLAND STREET, *Edinburgh, January* 1863.

ARTICLE II.—*On the Epidemic Influenzas of Iceland, especially the last one of* 1862. By JOHN HJALTELIN, M.D., Medical Officer of Iceland.

AMONGST all epidemical diseases of this century, few are more interesting than the epidemic influenzas, especially since it is evident that they get more and more frequent. In the history of this disease, Iceland has hitherto, on account of its natural isolation, been overlooked by the epidemiologists; but I think, nevertheless, that there are some interesting hints regarding this malady, which, if carefully collected, might be of some interest to medical science, and it is therefore that I venture to give some aphoristic description of the Icelandic influenzas, and of the late epidemic of this kind.

On entering on a short historical account of Icelandic influenzas, I must remark, that although the Icelandic people have been very sedulous, and even accurate, in collecting historical notes from all